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27TH ANNUAL MCGRAW-HILL SURVEY OF BUSINESS' PLANS FOR
RESEARCH AND DEVELOPMENT EXPENDITURES, 1982-85

Research and development (R&D) spending by U.S. companies is firmly on the comeback trail.

After de-emphasizing R&D from the mid-1960s to the mid-1970s, industry in recent years began beefing up R&D budgets. Now spending is set to take another big jump, according to McGraw-Hill's "27th Annual Survey of Business' Plans for Research and Development Expenditures".

Conducted in March and April, the survey found that firms plan to hike R&D spending this year by 17% to \$59.7 billion (Table I). That's on top of an estimated 16% rise in 1981. In addition, R&D budgets for the next few years also look strong--expenditures are currently projected to increase 37% between now and 1985. And since budgets for future years are typically raised as these years approach, actual spending in 1985 will likely exceed the current target of \$81.9 billion.

These results suggest that something of an R&D renaissance is underway. For example, Chart I shows that the pace of R&D activity took a jump in 1981 and could take a leap in 1982. The implication is that U.S. industry once again is depending on R&D to further its lead--or perhaps to regain its lead--in the technological marketplace. That lead has, of course, shrunk in the past decade; and the R&D boomlet in the past few years will not do a lot to increase competitiveness in the short run. The key thing, though, is that U.S. companies may

Chart I. R&D Spending is on the Rebound

Period	-----Annual Average % Change-----		
	R&D Spending	Inflation Rate	"Real" R&D Spending
1955-60	17.8%	2.5%	14.9%
1960-65	6.2	1.6	4.5
1965-70	5.0	4.2	0.8
1970-75	5.3	6.5	-1.1
1975-80	13.4	7.2	5.8
1981	16.3	9.2	6.5
1982	17.1	6.5 ^e	10.0

NOTE: Inflation is measured by the gross national product implicit price deflator.

^eEstimated.

again be planning for long-term growth via technological innovation.

This renewed stress on R&D is also evident when compared with companies' capital spending plans. These plans (based on a separate McGraw-Hill survey) call for only a 4% rise in capital expenditures in 1982, followed by a 25% rise from 1982 to 1985. If all plans are realized, R&D spending as a share of capital spending would rise from 15.9% in 1981 to 17.9% in 1982 to 19.6% in 1985 (Table V).

One reason a comparison of R&D versus capital spending is of interest is that both types of expenditures are expendable in times when companies are trying to conserve cash--i.e., in times of recession. As Chart II shows, the growth in spending for both capital goods and R&D (primarily wage payments) gets cut sharply in the year after a recession

takes hold. When firms see their sales and profits shrink, that is, they react by cutting expenditures that aren't tied to current operations.

Chart II. Recessions Wrack R&D and Capital Budgets

Recession Periods	—% Change from Previous Year—	
	Capital Spending	R&D Spending
1957	7.5%	17.0%
1958	-12.4	8.5
1960	8.6	9.3
1961	-1.7	3.8
1969	12.5	5.0
1970	6.1	-1.3
1974	14.0	7.7
1975	0.5	2.5
1980	9.3	15.0
1981	8.7	16.3
1982	3.9	17.1

NOTE: 1982 data based on McGraw-Hill surveys.

But this time around the pattern of sacrificing the long term in order to salvage the short term is in part being broken: Even as they sharply reduce capital expenditure growth in 1982, U.S. companies plan rapid increases in spending for R&D. And last year, as total capital spending growth slowed to an 8.7% advance, business' purchases of R&D capital goods surged 28% (Table VI).

Yet another way to look at the rapidly growing emphasis on R&D is to track it as a share of manufacturers' sales. This R&D/sales ratio, a measure of the relative resources companies allocate to research, peaked at 2.95% in 1964 (Table IX). It then tumbled to 2.13% in 1979, but has

since rebounded to 2.46% in 1981; and the ratio is projected to jump to 2.69% this year. The message of the survey, in short, seems to be that R&D in recent years has regained its high priority status of the 1950s and early 1960s.

Of Life and Taxes

While the survey does not ask companies why they have been boosting R&D budgets, several reasons suggest themselves. One is the Economic Recovery Tax Act legislated last August. This law gives firms a 25% tax credit for R&D expenditures in excess of the average spent in the three previous years. The government figures this new tax provision will save industry about \$450 million in taxes in fiscal year 1982 (ending September 30) and close to \$3 billion during the next four years. (The provision expires in 1986.)

In addition, last August's tax measures included faster write-off of plant and equipment. Specifically, equipment used for R&D purchased after December 31, 1980 may now be written off in three years. The jump in purchases of R&D capital equipment (Table VI) could in part be linked to the new depreciation schedules.

The new tax measures weren't enacted until last year, however, while the spurt in R&D spending started several years ago. So though the tax act should stimulate additional R&D spending, perhaps corporate strategy underwent a shift toward R&D before new tax incentives were even thought of. In the face of an energy crisis, a technological challenge from Japan, and a slow-growth economy plagued by inflation, American companies may well have decided that R&D was the place to start breathing new life into their businesses.

For example, the auto industry--symbol of U.S. manufacturing's relative decline--was cutting R&D in the first half of the 1970s. Meanwhile, imports were gaining market share. Since 1975, however, auto industry R&D spending has surged--up 16% a year on average through 1980. And the industry projects more 16% annual advances through 1985.

Another example is the petroleum industry, where R&D budgets were shrinking in the years just prior to the energy crisis. But once OPEC put its stamp on the world economy in 1973-74, oil companies started escalating their R&D efforts. From 1973 to 1980, spending shot up 18% a year on average. The projection for 1982 is 17%. Projections beyond 1982 are fairly weak, possibly reflecting the great uncertainty in today's oil market.

Nonetheless, industry as a whole foresees solid R&D spending growth through 1985. The tax act is certainly a plus. But more important prods, perhaps, are a shrinking world market share and a growing realization that the U.S. has been losing its claim to industrial and technological preeminence.

The Industrial Mix of R&D

The industry that spends the most on R&D--electrical machinery--also plans the the largest percentage increase in spending this year, 23.2% (Table I). If realized, that gain would lift expenditures to \$12.9 billion. This industry, which includes high-technology electronics and communications equipment manufacturers, expects R&D spending growth to continue strong, too. By 1985, electrical machinery producers project an R&D budget of \$18.9 billion, 46% greater than in 1982.

The (nonelectrical) machinery industry also expects R&D spending to spurt this year--up 21% to \$8.9 billion. Interestingly, both electrical and nonelectrical machinery companies intend to allocate large chunks of their R&D budgets to new products, 41% and 47% respectively (Table III). As a result, they also expect new products to account for one-fifth of sales by 1985 (Table II), an increase of several percentage points over new product sales expectations in the past two years (Table X).

The industry putting most stress on new product development is instruments, which plans to devote 80% of its R&D spending to that purpose. And by 1985, the payoff is expected to be that more than half of sales that year will be from new products.

After electrical machinery, the industry that does the most R&D spending is aerospace. In 1982, this industry projects a 12.8% gain in R&D expenditures to \$11.7 billion. If realized, that would put aerospace's R&D/sales ratio at 20.3%--far greater than any other industry's. However, the aerospace ratio is outsized in part because data in this report include government R&D funds spent by private companies. And aerospace is a major participant in government-funded R&D projects.

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NOTE: The other manufacturing category in the tables includes lumber, wood products and furniture, tobacco, printing and publishing, leather, jewelry, toys, and transportation equipment other than autos, trucks and parts and aerospace. The nonmanufacturing category includes mining, construction, electric and gas utilities, commercial enterprises and transportation.

SOURCES: National Science Foundation, McGraw-Hill Publications Company Economics Department

TABLE I
RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1980*	1981	----Planned----		1981-82	1982-85
	Estimated	Estimated	1982	1985	% Change	% Change
Iron & Steel	\$ 318	\$ 318	\$ 350	\$ 466	10.0%	33.0%
Nonferrous Metals	375	471	507	614	7.6	21.1
Electrical Machinery	9,137	10,511	12,949	18,931	23.2	46.2
Machinery	6,076	7,458	8,939	11,584	21.0	29.6
Autos, Trucks & Parts	4,843	5,411	6,270	9,316	15.9	48.6
Aerospace	9,626	10,406	11,736	15,179	12.8	29.3
Fabricated Metals	588	698	774	1,062	10.8	37.2
Instruments	2,270	2,843	3,300	4,829	16.1	46.3
Stone, Clay & Glass	401	459	522	681	13.7	30.3
Chemicals	4,608	5,607	6,663	9,322	19.3	39.9
Paper & Pulp	508	584	654	892	11.8	36.4
Rubber	646	687	767	1,055	11.6	37.5
Petroleum	1,565	2,068	2,424	2,895	17.3	19.5
Food & Beverages	517	646	718	921	12.5	28.4
Textile Mill Products & Apparel	102	119	132	183	11.5	38.2
Other Manufacturing	730	932	1,111	1,448	19.1	30.3
ALL MANUFACTURING	42,310	49,218	57,816	79,378	17.5	37.3
ALL NONMANUFACTURING	1,569	1,814	1,927	2,553	6.2	32.5
ALL INDUSTRIES	43,879	51,032	59,743	81,931	17.1	37.1

* Based on preliminary National Science Foundation data.

TABLE II
NEW PRODUCTS SALES - 1985

<u>INDUSTRY</u>	<u>Percent of 1985 Sales</u>	<u>Billions of Dollars</u>
Iron & Steel	9.5%	\$ 9.73
Nonferrous Metals	4.3	3.55
Electrical Machinery	21.1	41.68
Machinery	24.8	77.02
Autos, Trucks & Parts	30.7	68.60
Aerospace	39.6	37.24
Fabricated Metals	17.4	36.30
Instruments	55.5	45.15
Stone, Clay & Glass	6.4	4.50
Other Durables	6.2	12.27
TOTAL DURABLES	19.1	299.74
Chemicals	10.5	29.70
Paper & Pulp	22.6	26.38
Rubber	15.7	11.23
Petroleum	3.6	8.99
Food & Beverages	6.7	25.16
Textile Mill Products	10.8	7.18
Other Nondurables	10.2	26.97
TOTAL NONDURABLES	9.5	135.61
ALL MANUFACTURING	14.5	435.35

TABLE III

PERCENT OF RESEARCH & DEVELOPMENT EXPENDITURES GOING FOR
NEW PRODUCTS, NEW PROCESSES & IMPROVEMENT OF EXISTING PRODUCTS

INDUSTRY	-----In 1981-----			-----In 1982-----			-----1983-85 Average-----		
	New Products	New Processes	Improving Existing Products	New Products	New Processes	Improving Existing Products	New Products	New Processes	Improving Existing Products
Iron & Steel	56%	10%	34%	46%	20%	34%	46%	20%	34%
Nonferrous Metals	20	46	34	29	42	29	29	41	30
Electrical Machinery	41	12	47	41	11	48	41	12	47
Machinery	47	24	29	47	24	29	47	24	29
Autos, Trucks & Parts	61	19	20	61	19	20	61	19	20
Aerospace	41	9	44	32	29	39	32	24	44
Fabricated Metals	50	20	30	53	17	30	53	16	31
Instruments	40	51	9	80	11	9	80	12	8
Stone, Clay & Glass	17	23	60	24	35	41	24	36	40
Chemicals	25	31	44	26	30	44	26	47	27
Paper & Pulp	27	29	44	31	34	35	31	36	33
Rubber	32	17	51	34	20	46	34	21	45
Petroleum	20	71	9	19	71	10	19	68	13
Food & Beverages	16	22	62	17	22	61	17	24	59
Textile Mill Products & Apparel	5	49	46	6	47	47	6	48	46
Other Manufacturing	13	14	73	14	15	71	14	17	69
ALL MANUFACTURING	40	23	37	40	24	36	40	25	35

TABLE IV

RESEARCH & DEVELOPMENT AS A PERCENT OF SALES

<u>INDUSTRY</u>	<u>1981</u>	<u>1982</u>	<u>1985</u>
Iron & Steel	0.45%	0.47%	0.45%
Nonferrous Metals	0.87	0.87	0.74
Electrical Machinery	7.70	8.95	9.58
Machinery	3.64	4.00	3.73
Autos, Trucks & Parts	3.94	4.08	4.17
Aerospace	18.20	20.32	16.14
Fabricated Metals	0.57	0.57	0.51
Instruments	5.66	5.84	5.94
Stone, Clay & Glass	0.94	0.98	0.97
Chemicals	3.08	3.46	3.30
Paper & Pulp	0.75	0.78	0.76
Rubber	1.47	1.48	1.48
Petroleum	1.06	1.22	1.16
Food & Beverages	0.24	0.25	0.25
Textiles	0.19	0.20	0.22
Other Manufacturing	0.32	0.35	0.32
ALL MANUFACTURING	2.46	2.69	2.65

TABLE V

RESEARCH & DEVELOPMENT AS A PERCENT OF CAPITAL SPENDING

<u>INDUSTRY</u>	<u>1981</u>	<u>1982</u>	<u>1985</u>
Iron & Steel	10.03%	8.77%	11.71%
Nonferrous Metals	13.61	16.15	14.08
Electrical Machinery	101.95	118.47	141.81
Machinery	56.41	64.73	53.36
Autos, Trucks & Parts	53.68	62.83	78.35
Aerospace	161.83	182.52	236.43
Fabricated Metals	23.58	25.13	27.58
Instruments	124.15	116.20	118.65
Stone, Clay & Glass	14.62	16.16	19.08
Chemicals	41.23	45.54	54.01
Paper & Pulp	8.69	9.91	9.98
Rubber	38.81	35.35	41.05
Petroleum	7.79	8.70	7.24
Food & Beverages	7.86	10.07	10.87
Textiles	6.20	6.80	8.20
ALL MANUFACTURING	38.82	44.07	47.86
ALL NONMANUFACTURING	0.93	0.95	1.01
ALL INDUSTRIES	15.87	17.88	19.56

TABLE VI

RESEARCH & DEVELOPMENT CAPITAL EXPENDITURES
(Millions of Dollars)

<u>INDUSTRY</u>	<u>1980</u>	<u>1981</u>	<u>% Change</u>
Iron & Steel	\$12.4	\$ 9.5	-23.4%
Nonferrous Metals	80.7	148.5	84.0
Electrical Machinery	922.5	1,105.2	19.8
Machinery	2,592.9	3,106.6	19.8
Autos, Trucks & Parts	4,843.0	5,410.9	11.7
Aerospace	2,035.7	3,712.5	82.4
Fabricated Metals	296.5	315.5	6.4
Instruments	540.2	754.7	39.7
Stone, Clay & Glass	82.4	94.8	15.0
Chemicals	460.3	660.9	43.6
Paper & Pulp	117.8	114.0	-3.2
Rubber	59.9	70.0	16.9
Petroleum	344.4	413.2	20.0
Food & Beverages	60.8	52.8	-13.2
Textile Mills & Apparel	29.9	41.1	37.5
Other Manufacturing	171.7	197.7	15.1
ALL MANUFACTURING	12,651.1	16,207.9	28.1

TABLE VII

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Primary Metals	\$ 62	\$ 69	\$ 74	\$ 90	\$108	\$131	\$152	\$177	\$177	\$171	\$183
Iron & Steel	42	44	46	55	64	80	84	102	98	97	106
Nonferrous Metals	20	25	28	35	44	51	68	75	79	74	77
Machinery	330	358	455	543	669	781	930	949	901	914	958
Electrical Machinery & Communications	817	904	983	1,516	1,804	1,969	2,329	2,532	2,483	2,639	2,866
Radio & TV Receiving Equipment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Commun. Equip. & Elect. Components	74	141	200	575	748	868	1,162	1,324	1,404	1,591	1,773
Other Electrical Equipment	743*	763*	783*	941*	1,056*	1,101*	1,167*	1,208*	1,079*	1,048*	1,093*
Aerospace	829	999	1,285	2,138	2,574	2,609	3,090	3,514	3,829	4,042	4,712
Autos & Other Transp. Equipment	495	531	561	688	707	856	866	884	936	999	1,090
Fabricated Metal Products	52	55	65	116	135	162	138	145	136	146	153
Professional & Scientific Instrument	178	195	176	200	249	294	309	329	297	309	284
Scientific & Mechanical Measures	86	94	85	97	139	156	159	160	119	101	70
Optical, Surgical & Photo	92	101	91	103	110	138	150	169	178	208	214
Stone, Clay & Glass	40	45	46	60	69	75	81	88	88	96	100
Lumber & Furniture	10	10	10	10	14	12	12	10	10	10	11
Chemicals	374	407	445	641	705	792	891	980	1,101	1,175	1,239
Industrial Chemicals	269	289	315	460	503	553	600	666	706	738	809
Drugs & Medicines	40	50	60	94	104	128	154	162	180	195	216
Other Chemicals	65	68	70	87	98	111	137	152	215	242	214
Paper	29	33	32	36	35	42	49	56	59	65	69
Rubber	54	65	79	105	107	89	115	121	138	141	156
Petroleum	149	167	172	182	211	246	278	296	299	310	317
Food & Beverages	54	61	70	64	74	83	91	104	125	121	130
Textiles & Apparel	10	12	12	12	15	26	30	38	30	28	30
Other Manufacturing	53e	58e	64e	74e	93	105	118	119	105	65	54
ALL MANUFACTURING	3,536e	3,969e	4,529e	6,475e	7,569	8,272	9,479	10,341	10,714	11,230	12,354
ALL NONMANUFACTURING	94e	101e	111e	130e	162	117	139	168	194	234	276
ALL INDUSTRY	3,630	4,070	4,640	6,605	7,731	8,389	9,618	10,509	10,908	11,464	12,630

* - Includes Radio & TV

NA - Not Available

e - Estimated

SOURCE: National Science Foundation.

TABLE VII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Primary Metals	\$195	\$213	\$232	\$242	\$251	\$257	\$275	\$272	\$277	\$307	\$358
Iron & Steel	116	128	139	135	135	136	149	144	147	163	181
Nonferrous Metals	79	85	93	107	115	121	126	128	130	145	177
Machinery	1,015	1,065	1,217	1,326	1,483	1,546	1,729	1,860	2,158	2,549	2,985
Electrical Machinery & Communications	2,972	3,200	3,626	3,867	4,083	4,348	4,220	4,389	4,680	4,902	5,011
Radio & TV Receiving Equipment	NA	NA	47	45	55	57	70	64	48	49	51
Commun. Equip. & Elect. Components	1,872	1,989	2,249	2,425	2,520	2,671	2,604	2,739	2,913	3,019	2,913
Other Electrical Equipment	1,100*	1,211*	1,330	1,397	1,508	1,620	1,546	1,586	1,719	1,834	2,047
Aerospace	5,078	5,148	5,526	5,669	5,765	5,882	5,219	4,881	4,950	5,052	5,278
Autos & Other Transp. Equipment	1,182	1,230	1,344	1,354	1,499	1,556	1,591	1,768	2,010	2,477	2,425
Fabricated Metal Products	148	145	154	163	183	182	207	242	253	291	313
Professional & Scientific Instrument	331	403	468	542	663	742	744	746	838	961	1,075
Scientific & Mechanical Measure	74	80	87	104	118	123	131	133	163	186	221
Optical, Surgical & Photo	257	323	381	438	545	619	613	612	675	775	854
Stone, Clay & Glass	109	112	117	136	142	159	167	164	183	199	217
Lumber & Furniture	12	11	12	12	20	18	52	53	64	71	84
Chemicals	1,284	1,356	1,407	1,507	1,589	1,660	1,773	1,832	1,932	2,116	2,450
Industrial Chemicals	865	908	918	966	981	1,007	1,031	1,009	1,031	1,119	1,299
Drugs & Medicines	234	267	308	343	398	444	485	549	607	698	807
Other Chemicals	185	181	181	198	210	209	257	274	294	299	344
Paper	77	94	117	128	144	188	178	187	189	194	237
Rubber	158	162	168	182	223	261	276	289	377	426	469
Petroleum	393	397	371	371	437	467	515	505	468	498	622
Food & Beverages	144	157	164	183	184	199	225	231	246	253	278
Textiles & Apparel	32	38	51	57	58	60	58	59	61	64	69
Other Manufacturing	65	71	77	90	101	104	128	131	146	158	177
ALL MANUFACTURING	13,193	13,801	15,051	15,826	16,826	17,653	17,357	17,607	18,832	20,518	22,099
ALL NONMANUFACTURING	319	384	497	559	603	655	705	704	707	715	768
ALL INDUSTRY	13,512	14,185	15,548	16,385	17,429	18,308	18,062	18,311	19,539	21,233	22,867

NA - Not Available

* - Includes Radio & TV

TABLE VII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES
(Millions of Dollars)

INDUSTRY	1975	1976	1977	1978	1979
Primary Metals	\$443	\$506	\$532	\$542	\$613
Iron & Steel	215	256	260	260	293
Nonferrous Metals	228	250	271	282	320
Machinery	3,196	3,487	3,952	4,459	5,131
Electrical Machinery & Communications	5,105	5,636	5,928	6,743	7,927
Radio & TV Receiving Equipment	50	52	61	54	62
Commun. Equip. & Elect. Components	2,934	3,202	3,550	4,086	5,004
Other Electrical Equipment	2,121	2,382	2,317	2,603	2,861
Aerospace	5,713	6,339	7,089	7,680	8,290
Autos & Other Transp. Equipment	2,430	2,872	3,445	3,914	4,575
Fabricated Metal Products	329	358	393	397	479
Professional & Scientific Instrument	1,173	1,298	1,466	1,689	2,054
Scientific & Mechanical Measures	266	325	373	452	601
Optical, Surgical & Photo	907	974	1,092	1,237	1,453
Stone, Clay & Glass	233	263	287	331	352
Lumber & Furniture	88	107	127	136	151
Chemicals	2,727	3,017	3,261	3,594	4,033
Industrial Chemicals	1,391	1,524	1,663	1,814	2,023
Drugs & Medicines	981	1,091	1,157	1,281	1,445
Other Chemicals	354	401	441	499	565
Paper	249	313	337	394	454
Rubber	467	502	488	504	571
Petroleum	693	767	920	1,071	1,275
Food & Beverages	312	329	398	431	459
Textiles & Apparel	70	82	82	87	93
Other Manufacturing	205	217	250	280	317
ALL MANUFACTURING	23,391	26,067	28,955	32,254	36,774
ALL NONMANUFACTURING	705	845	978	1,152	1,373
ALL INDUSTRY	23,429	26,938	29,933	33,406	38,147

TABLE VIII
HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF CAPITAL INVESTMENT
(Percent)

<u>INDUSTRY</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>
Primary Metals	4.53%	8.12%	8.31%	6.12%	4.82%	8.91%	13.10%	10.66%	15.39%	15.55%	13.66%
Iron & Steel	4.47	7.46	6.97	5.34	4.71	8.08	10.37	7.61	11.40	12.76	12.05
Nonferrous Metals	4.65	9.62	12.17	7.95	5.00	10.63	19.43	23.44	27.24	21.76	16.74
Machinery	41.77	51.88	56.17	50.28	52.27	84.89	91.18	78.43	81.17	72.54	77.26
Electrical Machinery	151.30	177.25	189.04	207.67	243.78	339.48	328.03	248.24	236.48	266.57	280.98
Aerospace	552.67	666.00	558.70	577.84	559.57	931.79	1030.00	1033.53	1276.33	1010.50	1079.91
Autos & Other Transportation Equipment	36.67	30.00	36.91	31.85	45.32	73.16	64.15	55.25	63.24	63.23	56.48
Fabricated Metals	11.82	11.96	12.50	18.13	19.57	30.57	22.26	24.17	26.15	24.75	22.17
Instruments	161.82	139.29	110.00	105.26	131.05	196.00	162.63	137.08	129.13	118.85	97.93
Stone, Clay & Glass	10.00	10.23	7.19	6.67	8.85	13.64	11.41	11.28	12.57	13.33	14.29
Chemicals	26.52	36.67	44.50	44.21	40.99	60.00	76.15	61.64	68.81	74.37	72.03
Paper	7.07	7.33	6.27	4.50	4.32	7.37	7.54	7.27	9.52	10.48	9.86
Rubber	22.50	32.50	32.92	31.82	32.42	40.45	41.07	35.59	38.33	37.11	40.00
Petroleum	5.19	5.74	5.62	5.26	5.48	9.04	10.00	10.24	10.07	10.06	10.23
Food & Beverages	5.24	5.98	7.14	5.61	6.07	7.55	7.46	7.70	8.33	8.34	8.67
ALL MANUFACTURING	28.45	33.08	36.23	39.65	43.25	63.73	68.89	63.21	68.99	70.06	71.53
ALL NONMANUFACTURING	.44	.48	.46	.46	.53	.40	.45	.52	.60	.66	.77
ALL INDUSTRY	10.81	12.28	12.68	14.76	16.07	19.89	21.48	21.61	22.81	22.36	23.72

TABLE VIII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF CAPITAL INVESTMENT
(Percent)

<u>INDUSTRY</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
Primary Metals	9.75%	9.26%	8.53%	8.04%	8.04%	8.89%	9.79%	11.88%	13.58%	12.04%	8.97%
Iron & Steel	8.06	8.05	8.08	7.11	6.72	7.43	9.14	11.34	13.74	13.04	9.33
Nonferrous Metals	14.11	11.97	9.21	9.64	10.36	11.42	10.68	12.55	13.40	11.15	8.63
Machinery	63.04	47.54	41.82	43.91	51.14	42.59	45.74	59.05	66.81	64.21	57.07
Electrical Machinery	254.02	189.35	144.46	123.55	129.21	132.97	120.92	144.85	165.37	140.06	130.16
Aerospace	1238.54	971.32	472.31	453.52	468.70	455.97	593.07	774.76	727.94	580.69	349.54
Autos & Other Transportation Equipment	44.27	38.32	39.07	42.45	49.64	44.33	42.20	60.76	53.89	51.71	45.33
Fabricated Metals	17.41	16.86	13.51	12.64	13.46	13.58	16.97	20.17	17.69	16.08	16.13
Instruments	114.14	80.60	65.00	75.28	90.82	81.54	85.52	93.25	96.32	83.57	90.34
Stone, Clay & Glass	13.46	13.02	10.35	14.78	15.96	14.20	15.75	17.45	13.66	12.59	13.23
Chemicals	61.14	48.09	42.00	48.93	56.75	55.15	52.46	56.02	57.16	49.91	37.87
Paper	8.46	8.79	8.86	8.59	11.34	11.60	10.23	14.50	12.95	9.75	8.20
Rubber	33.62	27.46	25.85	27.16	23.23	24.39	30.00	36.58	36.60	27.48	29.87
Petroleum	11.20	10.23	8.28	7.67	8.81	8.88	9.98	9.69	9.77	10.64	8.51
Food & Beverages	8.23	8.40	7.77	8.93	8.36	7.21	6.78	6.90	7.50	6.99	6.90
ALL MANUFACTURING	62.14	54.31	47.98	49.07	52.03	48.67	46.92	52.40	53.17	48.43	41.53
ALL NONMANUFACTURING	.79	.85	.98	1.09	1.07	1.04	1.03	.94	.83	.75	.74
ALL INDUSTRY	21.91	20.14	18.91	19.64	19.70	18.40	17.10	16.87	16.25	15.42	14.57

TABLE VIII (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF CAPITAL INVESTMENT
(Percent)

<u>INDUSTRY</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Primary Metals	8.54%	10.10%	11.39%	11.71%	11.19%
Iron & Steel	7.12	8.42	9.32	10.32	9.48
Nonferrous Metals	10.51	12.69	14.41	13.36	13.39
Machinery	64.44	63.06	59.97	61.84	48.77
Electrical Machinery	162.58	153.99	126.94	118.51	108.89
Aerospace	340.06	375.09	352.69	238.51	157.31
Autos & Other Transportation Equipment	57.31	61.11	48.87	44.48	45.52
Fabricated Metals	16.70	16.05	15.78	13.78	15.70
Instruments	110.66	114.87	108.59	106.23	116.70
Stone, Clay & Glass	14.04	14.06	12.81	10.68	8.93
Chemicals	35.74	37.16	40.06	42.48	37.41
Paper	8.36	10.06	9.36	9.87	8.18
Rubber	40.26	38.32	29.58	24.00	26.31
Petroleum	7.23	7.12	7.25	7.68	7.87
Food & Beverages	7.76	6.85	7.77	7.22	6.93
ALL MANUFACTURING	42.59	43.48	41.83	40.46	37.27
ALL NONMANUFACTURING	.69	.76	.76	.76	.80
ALL INDUSTRY	14.86	15.71	15.11	14.45	14.10

TABLE IX
HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF SALES
(Percent)

<u>INDUSTRY</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>
Primary Metals	.26%	.34%	.28%	.29%	.35%	.49%	.48%	.57%	.57%	.53%	.53%
Iron & Steel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nonferrous Metals	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Machinery	1.35	1.60	1.88	1.91	2.26	2.95	2.89	2.80	2.60	2.51	2.44
Electrical Machinery	4.45	5.60	5.51	7.77	9.01	10.26	10.34	10.75	9.68	9.27	9.60
Aerospace	6.84	8.87	11.17	16.80	17.31	19.90	20.27	24.12	25.43	24.24	26.38
Autos & Other Transp. Equipment	1.99	2.61	2.09	2.90	2.75	4.31	3.54	3.34	3.44	3.52	3.43
Fabricated Metals	.34	.37	.40	.54	.60	.76	.58	.61	.58	.58	.64
Instruments	4.74	5.45	4.53	4.68	5.40	6.30	6.18	6.70	6.29	6.81	6.92
Stone, Clay & Glass	.56	.62	.53	.67	.81	.76	.71	.79	.79	.82	.81
Chemicals	1.99	2.14	2.08	2.82	3.01	3.50	3.44	3.76	4.12	4.08	3.97
Paper	.35	.38	.32	.34	.32	.38	.40	.44	.44	.45	.46
Rubber	1.08	1.41	1.39	1.87	1.86	1.27	1.43	1.49	1.70	1.57	1.62
Petroleum	1.18	1.28	1.22	1.17	1.29	1.57	1.71	1.76	1.78	1.80	1.76
Food & Beverages	.12	.13	.14	.13	.14	.16	.16	.18	.18	.18	.19
Textiles	.08	.10	.09	.09	.10	.16	.17	.22	.23	.21	.20
Other Manufacturing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ALL MANUFACTURING	1.26	1.49	1.57	2.06	2.31	2.53	2.61	2.79	2.89	2.81	2.94

NA - Not Available

TABLE IX (Continued)

HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF SALES
(Percent)

<u>INDUSTRY</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
Primary Metals	.50%	.48%	.48%	.54%	.52%	.48%	.53%	.53%	.47%	.42%	.37%
Iron & Steel	NA	NA	NA	NA	NA	NA	NA	.56	.51	.45	.36
Nonferrous Metals	NA	NA	NA	NA	NA	NA	NA	.61	.54	.48	.47
Machinery	2.87	2.69	2.59	2.69	2.90	2.74	3.06	3.32	3.28	3.28	3.23
Electrical Machinery	9.89	9.33	9.10	9.16	9.02	9.13	8.94	9.15	8.22	8.05	7.61
Aerospace	30.32	29.37	26.00	22.05	20.90	21.89	21.30	21.77	23.68	23.48	20.25
Autos & Other Transp. Equipment	2.85	2.43	2.62	2.90	2.66	2.67	3.16	2.64	2.73	2.86	2.99
Fabricated Metals	.51	.45	.42	.48	.41	.39	.45	.51	.47	.49	.46
Instruments	4.46	4.70	4.72	4.85	5.38	5.65	5.68	5.50	5.39	5.40	5.13
Stone, Clay & Glass	.83	.79	.79	.93	.89	.93	.98	.87	.85	.83	.82
Chemicals	3.82	3.69	3.52	3.64	3.54	3.50	3.65	3.60	3.37	3.32	2.92
Paper	.45	.51	.57	.61	.65	.77	.72	.73	.61	.59	.57
Rubber	1.54	1.42	1.33	1.37	1.49	1.60	1.71	1.63	1.80	1.75	1.68
Petroleum	2.14	2.08	1.82	1.68	1.88	1.91	2.07	1.87	1.63	1.43	1.06
Food & Beverages	.20	.21	.21	.22	.21	.21	.23	.22	.21	.19	.17
Textiles	.19	.19	.26	.29	.26	.26	.26	.25	.22	.20	.21
Other Manufacturing	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ALL MANUFACTURING	2.95	2.81	2.80	2.84	2.79	2.75	2.74	2.62	2.49	2.34	2.17

NA - Not Available

TABLE IX (Continued)
HISTORICAL RESEARCH & DEVELOPMENT EXPENDITURES AS A PERCENT OF SALES
(Percent)

<u>INDUSTRY</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Primary Metals	.46%	.62%	.56%	.45%	.45
Iron & Steel	.51	.55	.50	.43	.44
Nonferrous Metals	.77	.68	.65	.47	.58
Machinery	3.33	3.30	3.35	3.25	3.08
Electrical Machinery	7.95	7.62	6.91	6.83	7.05
Aerospace	19.66	20.66	21.54	20.46	18.02
Autos & Other Transportation Equipment	2.77	2.60	2.54	2.59	2.92
Fabricated Metals	.47	.46	.46	.41	.42
Instruments	5.32	5.18	5.13	5.35	5.22
Stone, Clay & Glass	.86	.86	.82	.75	.80
Chemicals	3.04	2.90	2.86	2.84	2.62
Paper	.60	.65	.65	.68	.69
Rubber	1.71	1.58	1.31	1.26	1.17
Petroleum	1.00	.93	.95	1.03	.95
Food & Beverages	.18	.18	.20	.20	.19
Textiles	.21	.22	.20	.20	.21
Other Manufacturing	.16	.15	.15	.14	.14
ALL MANUFACTURING	2.32	2.27	2.25	2.16	2.13

TABLE X
NEW PRODUCTS AS A PERCENT OF SALES FOUR YEARS AHEAD--HISTORICAL EXPECTATIONS
(Percent)

INDUSTRY	Spring 1957 For 1960	Spring 1960 For 1963	Spring 1961 For 1964	Spring 1962 For 1965	Spring 1963 For 1966	Spring 1964 For 1967	Spring 1965 For 1968	Spring 1966 For 1969	Spring 1967 For 1970
Iron & Steel	5%	10%	7%	5%	8%	9%	10%	7%	8%
Nonferrous Metals	5	7	11	9	9	13	11	9	16
Machinery	19	16	23	23	22	20	18	23	25
Electrical Machinery	18	18	16	22	22	16	23	24	26
Autos, Trucks & Parts	10	11	11	10	14	16	11	22	24
Aerospace	37	27	29	34	36	24	33	40	49
Other Transportation Equipment							19	23	12
Fabricated Metal Products	14	15	13	18	22	26	20	17	18
Instruments									
Chemicals	16	14	20	16	16	18	15	18	20
Paper	9	8	12	10	8	8	8	7	10
Rubber	5	7	7	6	8	19	14	4	7
Petroleum	2	4	5	6	4	3	4	5	7
Stone, Clay & Glass	8	9	13	13	12	14	13	17	20
Food & Beverages	7	8	12	12	7	10	9	11	12
Textiles	12	9	10	13	14	15	15	13	21
*ALL MANUFACTURING	10	12	14	14	13	15	13	15	17

* Includes miscellaneous manufacturing

TABLE X (Continued)

NEW PRODUCTS AS A PERCENT OF SALES FOUR YEARS AHEAD--HISTORICAL EXPECTATIONS
(Percent)

INDUSTRY	Spring 1968 For 1971	Spring 1969 For 1972	Spring 1970 For 1973	Spring 1971 For 1974	Spring 1972 For 1975	Spring 1973 For 1976	Spring 1974 For 1977	Spring 1975 For 1978	Spring 1976 For 1979
Iron & Steel	7%	7%	8%	8%	10%	7%	6%	6%	10%
Nonferrous Metals	14	11	8	10	10	8	9	10	7
Machinery	22	21	20	24	24	26	27	27	25
Electrical Machinery	24	20	20	19	17	20	21	20	15
Autos, Trucks & Parts	24	17	30	31	40	40	73	40	32
Aerospace	49	51	52	31	41	18	27	18	13
Other Transportation Equipment	20	10	37	15	4	9	9	15	7
Fabricated Metal Products	{ 24	{ 20	19	15	18	15	17	10	16
Instruments			35	23	24	22	24	19	21
Chemicals	16	16	17	13	16	14	15	9	24
Paper & Pulp	8	12	9	19	14	14	10	7	9
Rubber	9	8	6	12	12	17	14	6	9
Petroleum	8	6	6	7	6	5	3	3	3
Stone, Clay & Glass	16	15	32	14	11	13	13	11	13
Food & Beverages	8	8	13	10	10	9	6	8	12
Textiles	20	18	14	18	15	9	17	24	15
Miscellaneous Manufacturing	12	11	15	11	19	5	13	9	12
*ALL MANUFACTURING	17	16	19	16	18	15	18	14	15

*Includes miscellaneous manufacturing

TABLE X (Continued)

NEW PRODUCTS AS A PERCENT OF SALES FOUR YEARS AHEAD—HISTORICAL EXPECTATIONS
(Percent)

<u>INDUSTRY</u>	<u>Spring 1977 For 1980</u>	<u>Spring 1978 For 1981</u>	<u>Spring 1979 For 1982</u>	<u>Spring 1980 For 1983</u>	<u>Spring 1981 For 1984</u>
Iron & Steel	5%	9%	8%	7%	9%
Nonferrous Metals	6	10	7	4	5
Machinery	25	26	20	15	12
Electrical Machinery	16	18	21	17	17
Autos, Trucks & Parts	18	11	26	67	15
Aerospace	17	16	27	11	12
Other Transportation Equipment	17	9	9	NA	NA
Fabricated Metal Products	9	22	12	17	4
Instruments	21	24	15	31	25
Chemicals	19	12	12	10	9
Paper & Pulp	8	10	6	6	6
Rubber	8	14	16	8	11
Petroleum	3	3	2	5	3
Stone, Clay & Glass	11	10	12	10	8
Food & Beverages	11	17	10	13	17
Textiles	15	15	14	17	2
*ALL MANUFACTURING	13	14	13	15	11

*Includes miscellaneous manufacturing